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Guillain-Barré Syndrome: Rehabilitation Outcome and Recent Developments

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Guillain-Barré syndrome is the most common polyneuropathy causing major disability and respiratory failure. Respiratory complications are the main cause of death. Improved respiratory care and new treatment strategies such as plasmaphoresis and immunoglobulin have been shown to improve outcome. We studied the course and outcome of 37 patients with Guillain-Barré syndrome who were admitted to a rehabilitation and respiratory care facility over a 10-year period. There were 21 males and 16 females with a mean age of 62 ± 3 years. Fourteen patients developed respiratory failure requiring endotracheal intubation and mechanical ventilation. The mean duration of mechanical ventilation was 38 ± 10 days. All patients were successfully liberated from the ventilator. However, 83 percent of the patients were moderately to severely disabled at the time of discharge. Thirteen out of 37 (35 percent) developed long-term disability. None of the patients died over the period of follow-up. These results indicate that early recognition and treatment of respiratory complications in Guillain-Barré syndrome could reduce the morbidity and mortality of this condition.

INTRODUCTION

Guillain-Barré syndrome is a polyneuropathy characterized by an acute onset of symmetrical motor weakness with diminished or absent reflexes often associated with sensory and autonomic disturbances and a pathological picture of acute inflammatory demyelination and less commonly axonal damage. It is the most common acute neuropathy in the developed world [1] with an annual incidence that varies from 0.5 to 2.0 per 100,000 worldwide [2] and may be increasing in the urban population above the age of 50 [3]. In the United States, the estimated annual incidence is 3.0 cases per 100,000 population, with a marked increase in risk above age 40, and an estimated death rate of 628 cases per year for the epoch 1985-1990 [4]. Guillain-Barré syndrome is also the most common neuromuscular cause of respiratory failure requiring ventilatory support with respiratory complications [5]. However, in recent series, cardiac arrhythmias are shown to be the leading cause of death in Guillain-Barré syndrome [6]. The improved prognosis in recent years has largely resulted from advances in respiratory intensive care. This study reviews the respiratory outcome of 37 patients with Guillain-Barré syndrome treated at Gaylord Hospital Pulmonary Rehabilitation Unit from 1985-1995, and emphasizes current methods of treatment, respiratory care and rehabilitation.

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METHODS

A retrospective study of all patients discharged from Gaylord Hospital with a diagnosis of Guillain-Barré syndrome from 1985-1995 was conducted. Thirty-seven patients fulfilled the diagnostic criteria set forth by the National Institute of Neurological Disorders and Stroke as recently confirmed and expanded by Asbury and Cornblath [7]. Briefly, patients had to have progressive motor weakness of more than one limb and be areflexic. The majority of patients had cerebrospinal fluid and electrodiagnostic findings, supporting the clinical diagnosis.

RESULTS

There were 21 males (mean age 58 ± 5 years) and 16 females (mean age 68 ± 3 years). As shown in Table 1, the majority of patients had a preceding event or illness within two months of the onset of the syndrome. A flu-like illness, recent vaccination, upper respiratory tract infection and diarrhea were the most commonly reported prodromal events, with 41 percent of patients not reporting an apparent preceding event. Time to maximum weakness from the onset of prodromal symptoms was 12 ± 2 days with a range of two to 74 days. From the first sign of muscle weakness to maximum weakness was only 2.7 ± 0.5 days indicating a precipitous decline in muscle function. Forty-three percent of patients also had sensory involvement in addition to motor weakness and varying levels of areflexia (Table 2). Fourteen of the 37 patients required intubation and mechanical ventilation, with nine progressing to tracheostomy. The onset of respiratory failure was fairly acute in these patients developing within 4 ± 1 days from the start of peripheral muscle weakness. The mean duration of mechanical ventilation was 38 ± 10 days with a median of 20 days. The longest duration of mechanical ventilation was 120 days, but all patients were successfully liberated from the ventilator and decannulated. The most common complications of mechanical ventilation were post-tracheostomy bronchitis, mucus plugging, atelectasis and nosocomial pneumonia.

Upon discharge, 83 percent of the patients were moderately to severely disabled (Hughes disability scale) but stable enough to receive care and rehabilitation at home, with no patient needing ventilatory assistance (Figure 1). After one year, twenty-five percent of patients were without any symptoms or disability with another 34 percent having only minor symptoms or disability. Forty-three percent of patients with moderate to severe disability did not improve beyond liberation from mechanical ventilation.

DISCUSSION

Clinical course and complications

Guillain-Barré syndrome accounts for significant utilization of hospital resources and rehabilitation facilities. The economic burden for the United States is estimated at $2 to 3 billion annually [4]. The length of hospital stay increased with age with a median of nine days (range, 0-502 days) for persons aged 15 to 44, 11 days (range, 0-835 days) for persons aged 45 to 64 and 12 days (range, 0-537 days) for persons over 65 [4]. Approximately 40 percent of patients hospitalized with this disease will require rehabilitation at an average adjusted cost of $31,636 per patient (1993 dollars), and the disease accounts for new long-term disability in at least 1000 persons per year in the United States [8]. The need for mechanical ventilation most strongly predicts the length of stay for these patients [9]. While this disease usually causes ascending paralysis and subsequent respiratory failure,

Table 1. Demographics and clinical presentation.

Age, years	62 ± 3 (19-86)
Gender	
Male	21 (57%)
Female	16 (43%)
Preceding event	
None	15 (41%)
Flu-like illness	10 (27%)
Vaccination	10 (27%)
Respiratory tract infection	7 (19%)
Diarrhea	2 (5%)
Urinary tract infection	1 (3%)
Lymphoma	1 (3%)
Surgery	1 (3%)
From onset of prodromal symptoms to muscle weakness, days	9.3 ± 1.8 (1-60)
From onset of muscle weakness to maximum weakness, days	2.7 ± 0.5 (1-14)

Table 2. Neurologic and respiratory involvement in Guillain-Barré patients.

System Involvement	Frequency (%)
Sensory	43
Autonomic	14
Bulbar	35
Respiratory	38
Mechanical ventilation	38

uncommonly, pure respiratory or autonomic failure [6, 10, 11] or symptoms of upper airway obstruction [12] can be the presenting manifestation. Approximately 10 to 30 percent of patients with Guillain-Barré syndrome will have respiratory complications [5] with an estimated 14 to 25 percent requiring mechanical ventilation [10]. There are several causes of respiratory failure [5], including inability to protect the upper airway due to bulbar involvement [13], hypoventilation from denervation of diaphragm [14] and intercostal muscles and complications such as atelectasis (42 percent) and pneumonia (25 to 40 percent) [15]. It is diaphragmatic muscle weakness due to neural involvement that correlates best with ventilatory failure [5]. The central ventilatory drive response to CO_2 has been reported to be decreased and contributing to gas exchange abnormality independent of concomitant respiratory muscle weakness [16]. Interestingly, impairment of joint position and vibration sensation of the extremities in those patients with sensory involvement has been associated with a greater need for ventilatory support [17]. The reduction in vital capacity or maximum inspiratory mouth pressure may be the early signs of impending respiratory failure. As the disease progresses, the lowered lung volumes and flow rates impair the effectiveness of the cough and sigh mechanisms leading to mucus plugging, atelectasis, reduced lung compliance and increased venous admixture. The resultant increased work of breathing further results in hypercapnia, hypoxemia, increased respiratory rates and ventilatory failure. A reduction of vital capacity to less than 10 ml/kg is commonly associated with hypoxemia and hypercapnia, both of which tend to worsen during sleep

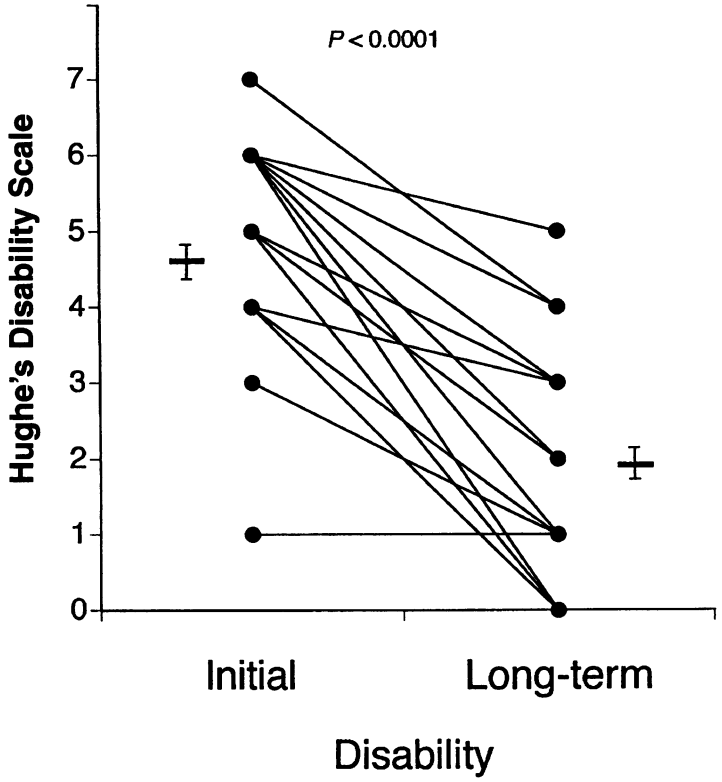

Figure 1. Disability at discharge and after, initial and long-term outcomes: Hughes Disability Scale. The horizontal bars denote mean + SEM. The Hughes disability scale: Grade 0 (healthy), Grade 1 (minor symptoms), Grade 2 (mildly disabled), Grade 3 (moderately disabled), Grade 4 (severely disabled), Grade 5 (requiring ventilatory assistance), Grade 6 (dead).

and the supine posture. Thus, patients with Guillain-Barré syndrome should be observed in the hospital for at least a few days, until the course of the disease plateaus. Initially, vital capacity, maximum inspiratory mouth pressure and arterial oxygen saturation should be followed every six hours or more frequently, along with monitoring of ventilation by arterial blood gas measurements. Those patients with vital capacity that is rapidly declining or is less than 20 ml/kg are appropriate candidates for observation in the intensive care unit. Patients with vital capacity less than 10 ml/kg and maximum inspiratory mouth pressure less than -25 cm H_2O usually require tracheal intubation and mechanical ventilation. However, in patients who have intact upper airway protective mechanisms and less profound respiratory muscle weakness with mild hypercapnic ventilatory, failure may only require non-invasive ventilation using mask positive pressure ventilation or negative pressure ventilation [18]. Nevertheless, these patients should also be monitored closely with measurements of vital capacity, maximum inspiratory pressure and arterial blood gases to detect those requiring endotracheal intubation and mechanical ventilation.

While elevated arterial PCO_2 is the commonest abnormality detected on the arterial blood gases, along with decreased arterial PO_2, careful attention should be paid to the alveolar-arterial oxygen gradient, a widening of which can be the earliest sign of a pulmonary embolism from deep venous thrombosis, occurring in up to two percent of patients [15]. Other complications of prolonged immobility include hypostatic pneumonia, frank sepsis

often originating from the lungs, the urinary tract or decubitus ulceration [8]. Meticulous and vigorous pulmonary toilet and chest physiotherapy while on the ventilator and after tracheal decannulation should minimize complications such as pneumonia and atelectasis. While the trachea can be intubated for up to three weeks, beyond this the incidence of laryngeal and tracheal complications rise sharply. Early tracheostomy in these patients will improve pulmonary toilet, facilitate communication and allow the patient to eat in the absence of bulbar involvement and swallowing dysfunction. In keeping with the protracted course of Guillain-Barré syndrome, the duration of mechanical ventilation is usually prolonged, between 8 to 12 weeks in some series and up to 120 days in our study. Longer durations of ventilation are distinctly unusual [19]. Case reports exist of patients requiring prolonged ventilation, even up to seven years [20-25]. A few patients are reported to have been liberated from ventilatory support up to 18 months after the initial illness [20]. The standard criteria for weaning from mechanical ventilation are also applicable to Guillain-Barré syndrome patients, though the vital capacity and the maximum inspiratory and transdiaphragmatic pressures have been separately favored by different groups as predictors of successful extubation [5, 26, 27]. In the series reporting the longest periods of ventilatory support, no patient could be weaned until the vital capacity improved to greater than one liter [20]. More importantly, trends in serial measurements of vital capacity, maximum voluntary ventilation, minute ventilation and maximum inspiratory pressure can be helpful in determining when to extubate. Tracheal decannulation can be safely undertaken when secretions are minimal and effectively cleared and swallowing is demonstrably coordinated.

Cardiac complications are frequent, especially arrhythmias and cardiac arrest in the setting of dysautonomia, with numerous reports of death from the use of succinylcholine for endotracheal intubation [5]. Furthermore, spectral analysis of heart rate and blood pressure variation in mechanically ventilated patients with Guillain-Barré syndrome has revealed a pattern of prominent broad respiratory heart rate variation peaks and narrow blood pressure variation peaks to predict sinus arrest [28].

Treatment

Plasmapheresis has been shown to reduce the duration of paralysis as well as reduce the duration of mechanical ventilation by 50 percent [29, 30], with the optimum number of plasma exchanges being shown to vary from two to four based on the severity of the disease [31]. More recently, intravenous immunoglobulin therapy has been shown to be equally efficacious [32, 33], with a study comparing the addition of methylprednisolone being under way [33]. Steroids alone are of no benefit [34]. To be effective, all treatments need to be started within two weeks of illness or relapse.

Prognosis

The impact of respiratory failure on the disease outcome is profound. In one study [9], patients requiring ventilatory support had lower Functional Independence Measure Rasch converted scores on presentation, gained less on these scores on discharge and had more than three times the acute length of stay than patients not requiring such support. There are anecdotal reports of impaired ventilatory capacity [35], or sleep apnea [20], occurring remote from apparent recovery from Guillain-Barré syndrome. The relapses do occur after a long asymptomatic interval, but they are uncommon [36]. Recovery is the rule in 80 percent of patients [2], with mortality rates varying from 3 to 18 percent overall [6] and as high as 15 to 30 percent in patients requiring mechanical ventilation [6, 15, 21]. The largest multi-center prospective trial to date, enrolling 297 patients, revealed that patients with preceding *Campylobacter* infection and those with the axonal degeneration

had a shorter time to peak of weakness, a prolonged peak phase, and a worse outcome with a high likelihood of residual muscle weakness. Older patients also fared worse [37].

SUMMARY

Guillain-Barré syndrome is the most common cause of respiratory failure and chronic disability due to neuromuscular disorders. Development of respiratory failure correlates directly with high morbidity and mortality as a result of this neuropathy. Early recognition and optimal respiratory care should minimize mortality from this neuropathy.

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